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Patenting Hominins

Taxonomies, Fossils and Egos

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Abstract ■ Palaeoanthropology – the study of hominin evolution – has features which differentiate it from most other sciences. It has long been characterized by the announcement of a dramatic discovery of fossil hominin remains – often following a long and arduous process of field exploration. Commonly this has been accompanied by naming a new species, or even a new genus, to mark the importance and uniqueness of the find. In time, the discipline of palaeoanthropology erodes these claims to uniqueness and merges the claimed individual species with other finds, while in turn new claims to uniqueness accompany new discoveries and announcements. The potential ways in which any set of materials can be classified is vast, and subjective elements determine classificatory schemes. In the study of fossil hominins such schemes do not just reflect preferences between 'lumpers' and 'splitters' but nationalisms, egos and the maintenance of the image of the scientist-hero.
Keywords ■ discoveries of fossil mankind ■ history of palaeoanthropology ■ hominins ■ taxonomy

It has been recognized for at least two decades in archaeological sciences (e.g. Shanks and Tilley, 1987) that while archaeological interpretation may tell us something about the past, it will also inform us about the time and context of that interpretation. Subjectivity – both socially or personally determined – is a given for interpretation, and this is particularly evident in the unfolding narratives of human origins that form the traditional field of palaeoanthropology.

The strongest backing for a piece of evidence in scientific research lies in its replicability. In the experimental sciences (say, chemistry) the basis for acceptance is that research methodology is made explicit, so that other scientists can repeat the experiment to prove – or attempt to disprove – the proposed results and their interpretation. In the observational sciences (say in astronomy or zoology) the described subject can be relocated and examined in the same or greater detail. 'Discovery' is the examination of evidence, the formulation of a nullifiable hypothesis, testing of the hypothesis against the evidence and conclusions which affirm the hypothesis and establish awareness of information which can be further amplified, or modified, by further research.

Much of archaeological 'discovery' follows a similar pattern of calm development. Regions are studied, sites are located, sample excavations are

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made and resulting finds (artefactual, economic and contextual) are described and studied to contribute to scientific interpretation. While every spotting of a surface find, or thrust of the trowel or sieving of the deposit may uncover some data, most 'discovery' is a modest contribution to incremental knowledge. And much of this interpretation is indeed *replicable*. The interpretative hypothesis may be that backed blades show use wear of scraping as well as cutting; or that offshore trade ceased with the arrival of a new ceramic tradition. It may be predictive: that elite tombs were located away from arable land, or that settlement in period x was seasonal between coast and uplands. Most information in archaeology is of this kind: augmenting knowledge in a way that can be tested by future work and be amplified, modified or eventually replaced.

This is distinct from the popular and media-driven image of archaeological discovery as the sudden dramatic uncovering of the unique and unexpected. This question leads the layperson to ask the archaeologist: 'What did you *find*?' They do not want an answer in terms of refinement of interpretations, enlargement of a sample, confirmation of a testable hypothesis. They want a material object – a royal tomb, a gilt statue, a hoard of coins, or an inscription that undermines assumed knowledge. And of course, from time to time, such an event does happen, such an object or site is identified and announced and archaeology enters the media to confirm the illusion that the discipline at its best is focused on an unending search for the unique and physical, not for the systematic expansion of knowledge and understanding that fill all the annual issues of over 400 journals[1] and vastly more monographs. The image of a Heinrich Schliemann or a Howard Carter, if not an Indiana Jones, has come to haunt the archaeological community.

But there is one strand that has often appeared to fulfil and match the fantasies of popular 'discovery' – the hunt for fossil hominids. And in the history of the sub-discipline of palaeoanthropology and the work of associated prehistorians, it is hard to avoid the conclusion that many of the participants – encouraged by the media and the demands of raising financial support – have played to this image of the explorer/discoverer/pioneer, at least for longer than in other areas of associated disciplines. Some in the history of the field have taken this to extremes of ego – see Morell (1995) for a detailed account of the era of the Leakeys (and their contender Donald Johanson) in East Africa. But there are certainly numerous modest, quiet research workers in the discipline too.

Perhaps the strongest contrast between this area of research and other fields of archaeological enquiry lies in the frequency with which claims have been made for uniqueness. This is seen in the crucial question of taxonomy. For much of the long history of research on fossil hominin sites and their associated finds, the emphasis has often been on dissimilarity, not similarity, on difference rather than links, on the individuality of new data rather than their contribution to enlarge the pool of information available for study.

The classic 'moment' in palaeoanthropology has become the announcement in the pages of a journal such as the weekly *Nature* or *Science* of a new discovery, together with its naming – and the immediate reporting of this announcement in the international print and electronic media. This commonly followed a commitment to silence and secrecy following the actual unearthing of the relevant find. This supports an image that the most important prehistoric research is a classic uncovering of the unexpected and unique. The science is clear and clean: the announcement comes first in a highly reputable journal, following peer review – but, ironically, the detailed publication of the find and its context may take years, sometimes many years, to appear, and, more seriously, some complete formal descriptions have never been published.

A parallel might lie in medical breakthroughs where a pharmaceutical company has funded complex and costly research and trials before announcing the release of a new drug into the market place, or when a medical equipment company introduces a new technology. But even here, rumours and media reports of a medical breakthrough can appear well ahead of the formal announcement. To extend the analogy further, throughout the long history of palaeoanthropology those announcing discoveries have often sought to 'patent' their find by giving it a unique place in hominid taxonomy. Attitudes to taxonomy can reflect attitudes in the whole field of study.

Taxonomy[2]

As in many sciences, we start to understand the meaning of a piece of data in archaeology or palaeoanthropology when we describe its relationships – how it fits into established groups, how it differs from established categories. Thus *classification* is a key to the expansion of knowledge. Just as the narrative of human deep prehistory has linked the classification of technology to the classification of time (mainly the subdivisions of the Pleistocene), the interpretations of hominin remains have been linked to their biological taxonomy.

The family name *Hominidae* originally encompassed all lines ancestral to modern mankind since the breakaway which led to the great apes (*Pongidae)*, together with extinct lines of development from that point. Thus for most of the history of the discipline the search for fossil remains of our ancestors, their close relatives and descendants, has been described as being for 'hominids'. However, most specialists now use the family name *Hominidae* to encompass both great apes and humans, living and extinct. Therefore now many if not most authors group species other than the great apes and their ancestors as 'hominins'. The disagreement on taxonomy of hominins is vast: not only the relationship but even the number of genera and the number of species in the hominin sub-family is a matter of constant

debate, as is the basis on which such a taxonomy should be drawn up (Groves, 2004).

This is not in itself surprising. For extinct species one cannot readily use the classic definition of a biological species as one whose members can interbreed to produce fertile offspring. It is easiest to classify separate species where there are contemporary specimens with quite different physical characteristics, whether occupying different or the same ecological niches. Thus it seems *Australopithecus africanus* and *Homo habilis* can be defined readily as species; as can *H. sapiens* and *H. floresiensis*. Arguments have been advanced that *H. sapiens neanderthalensis* and *H. sapiens sapiens* could interbreed – claims which may support their classification at the subspecies level in the classic biological species definition.

The paucity and isolation of finds made it difficult to define clear hominid phylogeny, the evolutionary development in which stages could clearly be mapped as separate genera or species. Phylogeny is arguably the strongest basis for species differentiation (Groves, 2004). If we had sufficient finds to make a complete sequence throughout the late Pliocene and the early Pleistocene, palaeoanthropologists could see more fully whether they can support the classificatory breaks in *Australopithecus* and *Paranthropus* which define different species on the basis of a small number of geographically and temporally isolated finds. With sparsely distributed sites and finds scientists select those criteria they consider most important to their classificatory schemes, either because of the importance they place on particular diagnostic features or because certain selectivity of features matches their preferred hypothesis. At one point in time a number of scientists may see a line of descent between, say, *H. sapiens*, *H. ergaster*, *H. habilis*, *A. africanus* and *A. afarensis* (e.g. Klein, 1999: 10, 575), but this will never be the universal view and may change with lumping or splitting. Most cladistics – systems of phylogenetic classification – have been based on skeletal remains in a framework of absolute chronology. One recent study challenges the validity of this whole approach, by analogy with studies on living higher primates: 'the type of qualitative and quantitative craniodental characters normally used to reconstruct the phylogenetic relationships of hominin species and genera are not reliable for this purpose' (Collard and Wood, 2000).

The scope for different classifications is of course huge. If we have two fossil finds there are two possible classification schemes (ab and a/b). For three fossils the options are five (abc, a/b/c, a/bc, ab/c, ac/b). For four the options are 15 (abcd, a/b/c/d, a/bcd, a/bc/d, a/b/cd, a/bd/c, ab/c/d, ab/cd, abc/d, abd/c, ac/b/d, ac/bd, acd/b, ad/b/c, ad/bc). This statistic – the number of ways a group of items can be partitioned into non-empty cells – is the Bell Number (Bell, 1934). A table of Bell numbers (Levine and Dalton, 1962: 418–19) demonstrates how many classificatory schemes can be placed on even a small number of separate finds such as fossils: for 15 it is already *190 million*, for 50 it is 1857×10^{45}. Hence the room for subjectivity in classificatory systems!

The subjective element therefore spreads from lumpers to splitters: those who prefer fewer taxa to those who prefer more. This operates both as classification by species and classification by genus. Over 50 years ago Mayr (1950) sought to group all fossil hominids in one genus and within three species: *Homo transvaalensis*, *H. erectus* and *H. sapiens*, the most 'minimalist' point of classification, which seems to have encouraged over a decade of calm. By the late 1960s the trend was to see two genera *Australopithecus* and *Homo* with a tightly limited number of species: *A. boisei*, *A. robustus*, *A. africanus*, *H. habilis*, *H. erectus*, *H. sapiens* (divided into primitive, Neanderthal and modern, either as subspecies or separate species).

Since then further finds have expanded the number of species commonly recognized and discussions have increased the number of genera. At any point in time, the number of hominin genera and species recognized by the majority of specialists will be limited, reflecting the merging into a single category of specimens previously categorized as separate. But in turn new claims for taxonomic uniqueness keep the pool large, until affected by their own cycle of merger. Figure 1 is indicative of the addition of new taxa to the hominins; while most of these have subsequently been subsumed and disappeared from the literature, the chart shows that the pattern of new names for new finds show no signs of

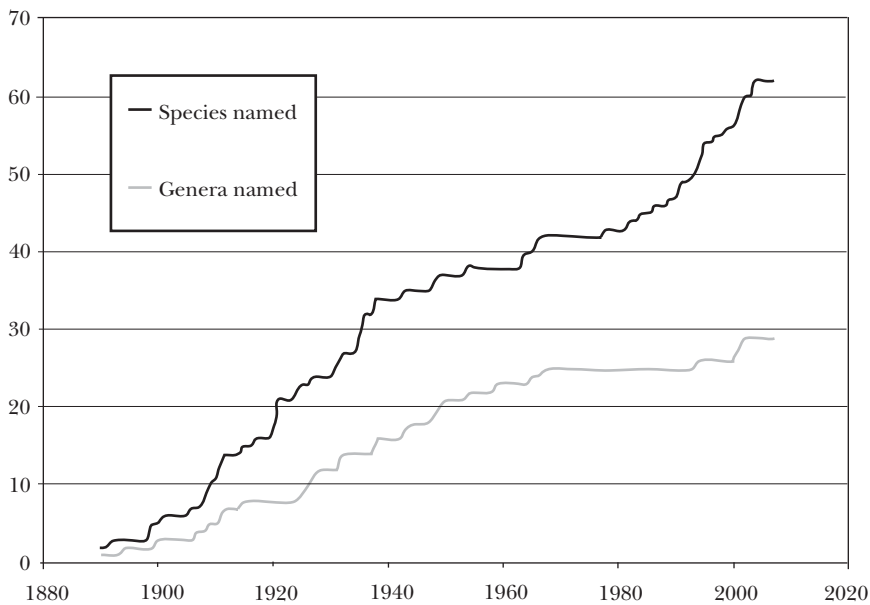

Figure 1 Hominin species (including subspecies) and genera named from 1890 to 2007. Note that about seven genera and 26 species names are currently in use (Foley, 2005)

flattening, though this is now mainly at the species (or subspecies) level; introduction of new genera has declined since 1970.

There has been a substantial number of different classificatory schemes, both from those associated with the newer discoveries and from those standing to one side of these. Perhaps the only consensus now is that there is no consensus.

Both 'splitters' – those who favour multiple species and genera – and 'lumpers' – those who prefer a classificatory and phylogenetic scheme with fewer taxons – vary in the criteria they consider essential to their classificatory scheme. It is a historical irony that the first fossil hominin species to be identified and the latest have both met the same criticism from extreme 'lumpers' – that of medical abnormality. The 19th-century critics of Neanderthal man claimed it to be *H. sapiens* deformed by rickets and arthritis. The 21st-century sceptics of the recently announced *H. floresiensis* (nicknamed the Hobbit), discovered on the Indonesian island of Flores, have suggested it to be *H. sapiens* suffering from microcephaly, in efforts to force the evidence of the unexpected into a prior model of what they consider ought to exist (Argue et al., 2006).

In the introduction to volume 4 of their comprehensive survey *The Human Fossil Record*, Schwartz and Tattersall (2002–5, vol. 4: ix) note:

> Although we recognise that not all morphs represent their own species, the diversity of morphologies we unearthed in the process of making detailed descriptions of so many fossils makes it clear that it is too soon to claim even that a rational alpha taxonomy of fossil hominids is in sight. Until it is possible to sort out the species-level variety of hominids to general satisfaction, it will be premature to proceed to higher level analyses.

But we may also note the comment by Foley on all the taxa still found in the literature:

> It is unlikely they are all biological species in the sense defined by Mayr. . . . They are almost certainly species in the sense defined by Simpson (i.e., independently evolving lineages). . . . At the microevolutionary level . . . these are probably a mixture of real biological species and evolving lineages of subspecies. (Foley, 2002: 33)

Patenting finds

The 'evolution' of classificatory systems in palaeoanthropology sees neither a simple cumulation of recognized species or genera, nor a systemic reduction of these. There is a trend over time that supposedly separate species of the past have been merged together by scientific consensus, while newer finds are declared new species, in turn (at least sometimes) to be corralled into larger groups. Recently Foley (2005) estimated 'there are currently claims for at least 26 hominin species'. We suggest this enthusiasm for individuality reflects a pattern peculiar to fossil hominin 'discovery' over a century and a half.

To claim a find as a new species is a bold statement. To claim a find as a new genus as well is bolder still. Arguably, naming a hominin find as a new genus does not just tell us little about the find: it actually tells us *nothing* about it. It declares: 'I have found something, it is not like anything anyone else has found, I am giving it a new name and it is up to the world to find more of the same elsewhere.' And of course the model fails when the next find is given the same approach, instead of being linked to this find.

The overall tendency from the earliest finds of fossil hominins was effectively to 'patent' the find by naming it formally as a new species or even a new genus. The fundamental of a patent is that future users respect the claims of the patentee, but in fact subsequent finds now seen as from the same species would be 'patented' under another name, occasionally even when reported by the same scientist.

Thus within *Hominidae* Gray 1825[3] at the genus level, *Homo* Linnaeus 1758 subsumes no less than 17 other claims for separate genera made between 1894 and 1954 (Wilson and Reeder, 2005). *Australopithecus* Dart 1925 is now divided by many into *Paranthropus* Broom 1938 and *Australopithecus* after having spent some decades as a single genus. However, many other genera have been absorbed within these three.

The standard reference (Groves, in Wilson and Reeder, 2005: 182) includes as genus *Homo* – in chronological order of the claim – the abandoned genera *Pithecanthropus* Dubois 1894, *Proanthropus* Wilser 1900, *Palaeanthropus* Bonarelli 1907, *Pseudhomo* Ameghino 1909, *Notanthropus* Sergi 1911, *Archanthropus* Arldt 1915, *Anthropus* Boyd Dawkins 1926, *Sinanthropus* Black and Zdansky 1927, *Cyphanthropus* Pycraft 1928, *Javanthropus* Oppenoorth 1932, *Praehomo* von Eickstedt 1932, *Africanthropus* Weinert 1938, *Maueranthropus* Montandon 1943, *Meganthropus* Weidenreich 1944, *Nipponanthropus* Hasebe 1948, *Telanthropus* Broom and Robinson 1949, *Europanthropus* Wüst 1950, *Atlanthropus* Arambourg 1954, and *Tchadanthropus* Coppens 1965.

Extinct genera are all limited to Africa since the departure of the fake Piltdown hominid *Eoanthropus dawsoni* Smith Woodward 1912. Non-*Homo* genera no longer in common acceptance (Schwartz and Tattersall, 2002–5) include *Zinjanthropus* Leakey et al. 1959 and *Paraustralopithecus* Coppens 1967. The trend is now to a demerger of *Paranthropus* from *Australopithecus* but with the emergence of other genera ascribed to earlier Pliocene hominin species: *Sahelanthropus tchadensis* Brunet et al. 2002, *Orrorin tugenensis* Senut et al. 2001, *Ardipithecus ramidus* White et al. 1994, *Ardipithecus kadabba* Haile-Selassie et al. 2004 and *Kenyanthropus platyops* Leakey et al. 2001 (Foley, 2005: 68–9). Thus while earlier genera have been merged, newly discovered species have been ascribed to new genera.

Africa and Asia have competed in the pattern of pioneer individualists 'patenting' individual finds with their own names. Non-*Homo* species have seen a similar trend where existing finds have been combined, yet new finds have been identified as separate species (e.g. Foley, 2005: 68; Klein, 1999: 188). After Dart identified the Taung child as *Australopithecus africanus* Dart

1925, his next find, later acknowledged as the same species, he first named *A. prometheus* Dart 1948. Meanwhile, Broom described his Transvaal australopith finds as *A. transvaalensis* Broom 1936 – later reclassified as a new genus *Plesianthropus*, *Paranthropus crassidens* Broom 1949 and *Paranthropus robustus* Broom 1938, before these were collapsed by most scientists into *A. africanus* and *A. robustus*. Louis Leakey, whose image as a fossil hunter came to epitomize the popular perception of the explorer-scientist in the 1950s and 1960s (Morrell, 1995), found *Zinjanthropus boisei* Leakey 1959, still generally acknowledged as a separate species but not a separate genus from other australopiths. Despite the corralling of the earlier finds into a reduced number of species, there has been a blossoming of new australopith species with *Australopithecus* (or *Paranthropus*) *aethiopicus* Coppens 1967, *A. afarensis* Johanson 1978, *A. anamensis* M Leakey et al. 1995, *A. bahrelghazali* Brunet et al. 1995 and *A. garhi* Asfaw et al. 1999. So, historically, as earlier finds have been combined into a smaller number of classificatory species, other individual researchers continue to 'patent' new species of their own, with nationalism as well as personal persuasion sometimes coming to the fore in making such decisions.

Homo, as noted above, has managed to draw in, to the satisfaction of most palaeoanthropologists, a large number of fossil hominin specimens previously attributed to numerous other genera. We have also seen a simplification of the species classification as numerous Asian and some African fossils were grouped together as *H. erectus* (though subsequently many finds, especially those from Africa, would be reclassified as *H. ergaster*). The species name *H. erectus* has managed to combine finds from Indonesia and China: *Anthropopithecus* (soon to be renamed *Pithecanthropus*) *erectus* Dubois 1892, *Sinanthropus pekinensis* Black 1927, *Javanthropus soloensis* Oppenoorth 1932, *H. modjokertensis* von Koenigswald 1936, *Sinanthropus lantianensis* Woodward 1964, with subspecies *H. erectus bilzingslebenensis* Vlcek 1978, *H. erectus reilingensis* Czarnetzki 1989, *H. erectus narmadensis* Sonakia 1991 and *H. erectus wushanensis* Huang et al. 1991, and the category includes fossils that have been named *Pithecanthropus robustus*, *P. dubius* and *Meganthropus palaeojavanicus* (Conroy, 1997: 286). It is hard to escape the impression of nationalism here – what 20th-century Chinese scientist was going to acknowledge his find as *Javanthropus* or Dutch colonial scientist as *Sinanthropus*? In Africa, finds which would eventually be seen as *H. erectus* (though later redefined as *H. ergaster*) included *Atlanthropus mauritanicus* Arambourg 1954.

Thus we see the reduction of numerous genera and species into one composite species *H. erectus* (and the subsequent regrouping of the African *Homo cf. erectus* as *H. ergaster*). Other early *Homo* species are *H. habilis* Leakey et al. 1964 and *H. rudolfensis* Alexeev 1986 in Africa, and most recently and importantly *H. floresiensis* Brown et al. 2004 and the ambiguous *H. georgicus* Vekua et al. 2002. Wood and Collard (1999) argue that *H. habilis* and *H. rudolfensis* should not be placed in the genus *Homo* but be classed as *Australopithecus*.

Late *Homo* has also seen a reduction from a large number of individual finds attributed to a number of individual species, with grouping either into a single species *H. sapiens* (archaic, neanderthal and fully modern forms) or different species – *H. heidelbergensis* Schoetensack 1908, *H. neanderthalensis* King 1864, *H. sapiens*. But, as with the pattern identified above, while numerous separately claimed species have been folded into these simpler categories, new species have been 'patented'. Now grouped with *H. neanderthalensis* are *H. primigenius* Schwalbe 1901, *H. spyensis* Krause 1909, *H. mousteriensis* Klaatsch and Hauser 1909, *H. calpicus* Keith 1911 and *H. gibraltarensis* Battaglia 1924 and the subspecies *H. neanderthalensis aniensis* Sergi 1935.

A long list of *Homo* species is now formally recognized as subsumed within *H. sapiens* – excluding the early taxonomies of quasi-species proposed by Linnaeus in 1758, and of multi-species proposed by Bory de St Vincent in 1825. From a more modern scientific era it includes *priscus* and *spelaeus* Lapouge 1899, *grimaldii* Lapouge 1906, *aurignacensis* Klaatsch and Hauser 1910, *eurafricanus* Sergi 1911, *proto-aethiopicus* Giuffrida-Ruggeri 1915, *capensis* Broom 1917, *wadjakensis* Dubois 1921, *cro-magnonensis* and *grimaldiensis* Gregory 1921, *drennani* Kleinschmidt 1931, *palestinus* McCown and Keith 1932.

Also *Homo* but of uncertain species are *H. steinheimensis* Berckhemer 1936, *H. sapiens protosapiens* Montandon 1943 and *H.* (*erectus* or *sapiens*) *palaeohungaricus* Thoma 1966.

Other separate species have been linked to *H. heidelbergensis* or 'archaic' *sapiens*, such as *H. rhodesiensis* Woodward 1921 and *H. helmei* Dreyer 1935. The latter name has been resurrected to fit a complex reinterpretation of the emergence of modern humans (Foley and Lahr, 1997): another example of the use to which a name, once introduced, can be put.

New possible species have emerged in the taxonomic discussions: *H. antecessor* de Castro et al. 1997, *H. cepranensis* Mallegni et al. 1993 and, most recently and significantly, *Homo floresiensis* Brown et al. 2004. A few other bids to 'patent' separate species have been found in the literature like *H. louisleakeyi* Kretzoi 1984 and *H. microcranous* Ferguson 1995.

A pattern

The history of palaeoanthropology for over a century, as exemplified through taxonomy, shows certain trends which we can attempt to characterize.

Fundamental to much of this is the pioneer explorer/scientist who makes a breakthrough discovery. This is often in a harsh physical environment, and may be the result of many years of searching. The individual is usually male; his fame is associated with the site of the discovery. The announcement of a new fossil hominid find has drama attached: secrecy followed by the release of a paper in a weekly science journal (rather than

the slow process of the specialist quarterlies) and appropriate media attention follows. The process of unearthing of fossil hominin material is proclaimed in dramatic terms. Sometimes the narrative comes to include a story of rejection or disbelief from the wider community before the achievement is recognized or the hard work pays off.

The individual hero/scientist had developed by the 1970s and 1980s into a team with more than one individual identified as responsible for the discovery. But sharing the credit did not always extend to acknowledging the contribution of predecessors working in the same area, or rival teams researching the same problems nearby; the primacy of the discovery was the key.

In more recent announcements the formality of naming the discovery team, in line with most scientific literature, has changed. Names which might once have earned a generous acknowledgement in a footnote are now listed as co-authors: a two-page paper can have a dozen joint 'authors'. This reflects the pressure on academics who are accountable for productivity, and each author can claim this publication as theirs. The dominance of the expedition leader remains in reality, as well as in wider recognition by their peers and the wider public.

We have shown mathematically how subjective is classification, with the Bell Number showing the range of classificatory schemes available. This subjectivity has commonly manifested as a claim that the new find is unique, as a new species in an established genus or even a new genus – literally *sui generis*. By giving it a new name, the announcement is patenting the find and linking the species to the original discovery.

Nationalism seems to have played a part in the determination to identify a find as unprecedented, as a hitherto unidentified species. This may be the nationality of the location, or the nationality of the discovery in a colonial setting, or the nationality dominating the research team. National pride may enter the selection of a name, which then makes it more difficult for the next find, under a different nationality, to accept that name for their find.

With limited data it is difficult to assess accurately the survival rate of different late Pliocene and Pleistocene fossil hominins. With such data it is easier to study the survival rate of newly patented species in the literature. The recovery of fossil hominin skeletal material operates, and has always operated, in a contemporary framework: that of physical access, national priorities, research funding and individual research passions. The interpretation of these finds, and in particular their initial naming, so frequently claiming uniqueness, emphasizes the subjectivity of these frameworks. The leader of a research team may need to over-emphasize the uniqueness and drama of a 'discovery' in order to attract research funding from outside the conventional academic sources, and they will certainly be encouraged in this by the print and electronic media, looking for a dramatic story.

The closest parallel lies in major discoveries of new species of larger dinosaurs, for which the media has a strong fascination: the more grotesque the reconstructed fossil, the greater the interest. But dinosaurs are still abstract science; in fossil hominins we are looking at our own forebears and relatives.

Groves, in reviewing primate taxonomy, suggests 'our predecessors had no real philosophy of what taxonomy should be trying to do, beyond mere pigeonholing' (2004: 1121). The history of the discipline suggests a frequent unwillingness to place a find in the existing pigeonholes, requiring that to be done by later writers.

Today, the survivors in the literature may represent a little more than 14 species (seven in genus *Homo*) (Wood and Collard, 1999), as many as 26 species (12 in genus *Homo*) (Curnoe, 2008; Foley, 2005), or even 35 species (14 in genus *Homo*) (Gyenis, 2002). Following the experience of the discipline we can be reasonably certain that some of these will be folded together to make combined species, but that new finds will be patented as new species, if not new genera, to continue the cycle associated with a discipline where 'discovery' plays a unique role.

Acknowledgements

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Notes

1 The European Reference Index for the Humanities classified 419 archaeology journals and 39 in 'evolutionary anthropology' (European Science Foundation, 2007).
2 For the basic sources and references on key taxonomic naming of hominin finds see Wilson and Reeder (2005) and Schwartz and Tattersall (2002–5).
3 I have followed the convention of giving the originator and date of a taxonomic name after the name itself.

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I have avoided repeating here the basic sources and references on key taxonomic naming of hominin finds: for these see Wilson and Reeder (2005) and Schwartz and Tattersall (2002–5).

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